Proton Plan

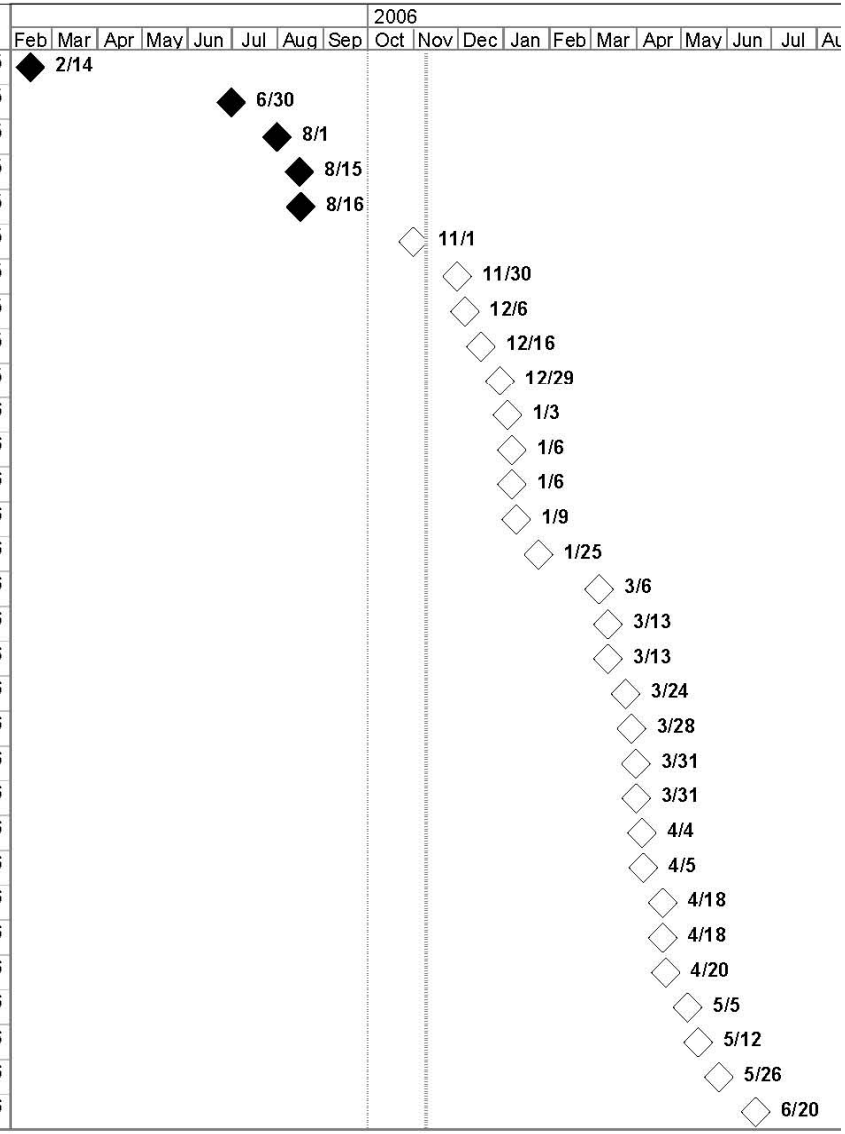
Cost and Schedule Report

November 2005 PMG

Jeff Sims

Milestones to Mid 2006

WBS	Name	MS Class	Date
1.1.1.1.2	Linac Task Force Phase 1 Report Issued	C	2/14/05
1.1.1.1.4	Linac Task Force Phase 2 Report Issued	C	6/30/05
1.1.2.1.6	Linac Quad PS Project Decision	C	8/1/05
1.3.1.1.3	WQB Design Complete	C	8/15/05
1.3.4.1.1.3	MI RF Cavity Prototype Decision	C	8/16/05
1.5.3	Submit Final Proton Study Group Report	C	11/1/05
1.3.1.3.4	WQB P.S. Ready for Installation	B	11/30/05
1.2.2.1.2.6	OrBump Magnets Ready for Install on Girder	B	12/6/05
1.3.1.1.6.4	WQB Ready for Installation	B	12/16/05
1.2.5.1.2	Gamma-t Studies Complete	C	12/29/05
1.2.4.1.4	30 Hz Harmonic Project Decision	C	1/3/06
1.2.2.1.3.4	OrBump Stripline Assy Complete	B	1/6/06
1.2.2.2.12	OrBump Power Supply Ready for Installation	B	1/6/06
1.2.1.1.6	Booster RF Report Issued	C	1/9/06
1.2.2.1.4.5	OrBump Girder Assy Complete	B	1/25/06
1.3.4.2.2	MI RF Scope Decision	C	3/6/06
1.2.7.1.3	Flex Tube Installation Complete	A	3/13/06
1.4.4	Start 2006 Shutdown	**C**	**3/13/06**
1.3.3.1.4.1.4	Barrier Bucket Cavity Installation Complete	A	3/24/06
1.2.11.4.23	Booster Dump Relocation Installation Complete	A	3/28/06
1.3.1.3.6	WQB P.S. Installation Complete	B	3/31/06
1.3.2.2.5	MI-8 Collimators Installation Complete	A	3/31/06
1.2.13.1.8	Booster RF AC Pulsed Power Improvements Installation Complete	B	4/4/06
1.3.3.2.2.3	Injection Kicker Mod Ready for Installation	C	4/5/06
1.3.1.2.4	WQB Align/Install Complete	B	4/18/06
1.3.1.3.7	WQBs System Installed	A	4/18/06
1.2.2.3.1.5	OrBump System Installation Complete	A	4/20/06
1.3.3.2.3.5	Injection Kicker Mods Complete	B	5/5/06
1.4.5	Finish 2006 Shutdown	**C**	**5/12/06**
1.2.2.5	OrBump System Commissioned	A	5/26/06
1.2.3.1.7	Corr Prototype Design Complete	C	6/20/06



Near Future Project Reviews

WBS	Name	Start	Finish	% Complete
1.3.2.1.2.2	Review Concept for MI-8 Collimation System	6/7/05	6/7/05	100%
1.2.2.2.4	OrBump P.S. Design Review	6/15/05	6/15/05	100%
1.2.11.2	Review Booster Dump Relocation Design	7/5/05	7/5/05	100%
1.1.2.1.3	Linac Quad PS Conceptual Review Prototype	8/2/05	8/2/05	100%
1.2.11.4.4	Booster Dump Relocation Review Monorail Design	10/10/05	10/28/05	100%
1.2.4.1.3	Review 30 Hz Harmonic Concept	1/3/06	1/3/06	0%
1.2.5.1.3	Gamma-t Review/Project Decision	1/3/06	1/3/06	0%
1.3.2.1.3.2	Review Concept for MI Collimation System	3/29/06	3/29/06	0%
1.1.4.1.3	200 Mhz LLRF Design Review	4/5/06	4/5/06	0%

Critical Path Analysis to mid 2006

WBS	Name	St	Fin	Float	
1.2.2.3.1.2	Install OrBump Magnet System	3/29/06	4/7/06	9 d	Orbump
1.2.2.3.1.4	OrBump System Survey	4/10/06	4/18/06	9 d	
1.2.2.3.2.2.3	400 MeV Survey	4/19/06	4/24/06	9 d	
1.2.2.3.2.3.1	400 MeV Vent Vacuum/Disconnect Electrical/LCW	3/20/06	3/21/06	9 d	
1.2.2.3.2.3.2	400 MeV Remove Magnets & Other Components	3/22/06	3/28/06	9 d	
1.2.2.3.2.3.4	400 MeV Connect Vacuum System/Pump Down/Leak Check	4/25/06	4/27/06	9 d	
1.2.2.3.2.3.5	400 MeV Connect Water/Electrical	4/28/06	5/1/06	9 d	
1.3.1.2.2	WQB Align/Install (5 units)	3/1/06	4/18/06	3 d	WQB
1.3.1.2.3	WQB Align/Install (Remaining 2 units)	4/19/06	5/9/06	3 d	
1.3.3.2.1.5	Inj Kicker Mods	3/13/06	4/7/06	25 d	Inj. Kicker
1.3.3.2.3.2	Inj Kicker Mods Install Low Conductivity Water for Control Skid	4/6/06	5/3/06	5 d	

<10 days on installation related tasks
<30 days on fabrication related tasks

Note: The RLS has multiple critical paths that lead to installation activities in one of the three shutdowns.

PROTON PLAN

Earned Value

		% Complete		Labor, k					M&S, k					Total, k	
				Estimate		IDT	Cost	Schedule	Estimate		IDT	Cost	Schedule	Cost	Schedule
		Planned	Actual	BCWS	BCWP	ACWP	Variance	Variance	BCWS	BCWP	ACWP	Variance	Variance	Variance	Variance
1	Proton Plan	14.1%	13.7%	1,747	1,688	1,695	-7	-59	843	825	734	91	-19	84	-77
1.1	**Linac Upgrades**	1.7%	1.8%	**74**	**80**	**86**	**-6**	**6**	**7**	**7**	**2**	**5**	**0**	**0**	**6**
1.1.1	Linac PA Vulnerability	0.2%	0.2%	4	4	12	-9	0	5	5	0	5	0	-4	0
1.1.2	Linac Quad Power Supply	14.8%	17.2%	60	69	73	-4	10	2	2	2	0	0	-3	10
1.1.4	LLRF	1.6%	1.0%	11	7	0	7	-4	0	0	0	0	0	7	-4
1.2	**Booster Upgrades**	9.5%	8.4%	**503**	**444**	**409**	**34**	**-59**	**340**	**301**	**178**	**123**	**-39**	**157**	**-98**
1.2.1	Determine Rep Rate Limit	41.2%	12.5%	15	4	6	-3	-11	0	1	0	1	1	-2	-10
1.2.2	Orbump System	73.5%	68.0%	173	155	150	5	-18	130	125	126	-1	-5	4	-23
1.2.3	Corrector System	3.2%	2.3%	126	101	153	-52	-25	35	16	20	-4	-19	-56	-44
1.2.4	30 Hz Harmonic	6.0%	5.3%	67	57	54	3	-11	30	30	11	19	0	22	-11
1.2.5	Gamma T System	5.8%	5.8%	28	28	2	26	0	0	0	0	0	0	26	0
1.2.7	Drift Tube Cooling	18.7%	18.7%	2	2	0	2	0	0	0	0	0	0	2	0
1.2.9	Booster SS RF Upgrade	0.0%	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
1.2.11	Booster Dump Relocation	47.6%	43.3%	81	76	36	40	-5	144	129	21	108	-15	148	-20
1.2.12	Booster Chopper	0.0%	0.0%	0	0	0	0	0	0	0	0	0	0	0	0
1.2.13	Booster RF Modifications	2.1%	4.0%	11	21	8	13	10	0	0	0	0	0	13	10
1.3	**Main Injector Upgrades**	40.2%	40.7%	**760**	**755**	**897**	**-142**	**-5**	**494**	**514**	**550**	**-36**	**20**	**-177**	**15**
1.3.1	Large Aperature Quads	66.5%	70.6%	634	651	788	-137	17	293	334	352	-18	40	-155	57
1.3.2	MI Collimation System	21.9%	17.8%	80	57	82	-25	-24	119	105	100	5	-14	-20	-37
1.3.3	NuMI Multibatch Operation	15.1%	14.3%	40	41	16	25	0	79	72	97	-24	-7	1	-6
1.3.4	MI RF Upgrade	30.8%	34.1%	6	7	11	-4	1	3	3	2	1	0	-3	1
1.4	**Management**	24.0%	24.1%	**404**	**404**	**304**	**100**	**0**	**3**	**3**	**4**	**-2**	**0**	**99**	**0**
1.5	**Proton Study Group**	50.1%	50.0%	**6**	**6**	**0**	**6**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**

Note: Includes CR-1

EV Analysis

- M&S Cost Variance and Schedule Variance are reasonable.
  - A few things stand out:
    - 1.2.11 (BDR) M&S looks underspent by $108k, but this is actually due to the delay in the Civil Construction… shutdown moved.
    - 1.3.1 (WQB) M&S is overspending – CR-2 will correct this.
    - 1.3.3 (NuMI Multibatch) Injection Kicker is procuring quicker than planned.
- Labor Cost Variance and Schedule Variance are high in areas:
  - Cost Variance seems reasonable at a high level. However labor CV on 1.3.1 (WQB) seems significant.
    - CR-2 will correct the Labor CV on 1.3.1
  - Schedule Variance is notable on 1.1.4 (LLRF), 1.2.2 (Orbump), 1.2.3 (Correctors), 1.3.1 (WQB), 1.3.2 (MI Coll)
    - 1.1.4 (LLRF) and 1.2.1 (Det. Rep Rate Limit) are being delayed from the lack of RF resources available due to operational issues. Now Assigned.
    - 1.2.2 (Orbump) is being delayed because it is not as critical to complete the power supply fabrication now that the Shutdown has been postponed to early 2006.
    - 1.2.3 (Correctors) Prototype work is just not a linear effort.
    - 1.3.1 (WQB) Design change delayed progress - CR-2 will correct
    - 1.3.2 (MI Coll) Delays in simulation and radiation measurements.
  - Under reporting on 1.2.4(Gamma-T), 1.2.11 (BDR), 1.3.3 (NuMI Multi batch)
    - Playing catch up with some AD personnel effort reporting.

PROTON PLAN

M&S Obligation

M&S Spending by Obligation in $k		Planned Estimate			Prior Years	This FY to date		ITD	% M&S Used		
	Equation	*(A)*	*(B)*	*(C)*	*(D)*	*(E)*	*(F)*	*(D+F)*	*(D+F)/(A)*	*(D+F)/(B)*	*(D+F)/(C)*
		Through this month	Through FY06	Total	Obl.	Obl.	Obl+RIP		ITD/this month Est	ITD/FY05+ FY06 Est	ITD/Total Est
1	**Proton Plan**	2,837.3	6,894.6	10,048.9	2,339.4	123.9	426.9	2,766.3	97%	40%	28%
1.1	**Linac Upgrades**	**1,471.0**	**1,662.9**	**3,419.8**	**1,465.2**	**0.0**	**0.0**	**1,465.2**	**100%**	**88%**	**43%**
1.1.1	Linac PA Vulnerability	1,469.0	1,474.1	3,099.6	1,463.6	0.0	0.0	1,463.6	100%	99%	47%
1.1.2	Linac Quad Power Supply	2.0	188.7	188.7	1.6	0.0	0.0	1.6	80%	1%	1%
1.1.4	LLRF	0.0	0.0	131.5	0.0	0.0	0.0	0.0	0%	0%	0%
1.2	**Booster Upgrades**	**602.1**	**3,794.5**	**5,181.4**	**247.0**	**71.9**	**374.9**	**621.8**	**103%**	**16%**	**12%**
1.2.1	Determine Rep Rate Limit	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0%	0%	0%
1.2.2	Orbump System	130.0	138.6	138.6	124.5	1.7	6.2	130.7	101%	94%	94%
1.2.3	Corrector System	49.0	2,516.6	2,777.2	20.7	8.8	24.9	45.6	93%	2%	2%
1.2.4	30 Hz Harmonic	50.0	50.0	1,108.0	24.9	0.0	0.0	24.9	50%	50%	2%
1.2.5	Gamma T System	0.0	205.2	205.2	0.0	0.0	0.0	0.0	0%	0%	0%
1.2.7	Drift Tube Cooling	0.0	3.1	3.1	0.0	0.0	0.0	0.0	0%	0%	0%
1.2.9	Booster SS RF Upgrade	0.0	0.0		0.0	0.0	0.0	0.0	0%	0%	0%
1.2.11	Booster Dump Relocation	167.0	285.0	285.0	76.8	23.3	134.7	211.5	127%	74%	74%
1.2.12	Booster Chopper	0.0	102.6	171.0	0.0	0.0	0.0	0.0	0%	0%	0%
1.2.13	Booster RF Modifications	205.3	492.6	492.6	0.0	38.1	209.1	209.1	102%	42%	42%
1.3	**Main Injector Upgrades**	**749.2**	**1,422.2**	**1,432.7**	**622.8**	**52.0**	**52.0**	**674.8**	**90%**	**47%**	**47%**
1.3.1	Large Aperature Quads	343.2	435.5	435.5	362.2	15.1	15.1	377.2	110%	87%	87%
1.3.2	MI Collimation System	208.8	621.8	632.3	175.6	11.8	11.8	187.4	90%	30%	30%
1.3.3	NuMI Multibatch Operation	190.1	357.9	357.9	83.4	25.1	25.1	108.5	57%	30%	30%
1.3.4	MI RF Upgrade	7.0	7.0	7.0	1.7	0.0	0.0	1.7	24%	24%	24%
1.4	**Management**	**15.0**	**15.0**	**15.0**	**4.4**	**0.0**	**0.0**	**4.4**	**30%**	**30%**	**30%**
1.5	**Proton Study Group**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0%**	**0%**	**0%**

Effort for October '05

WBS	WBS Name	Actual FTE	Plan FTE	
1	Proton Plan	28.2	35.1	
1.1	Linac Upgrades	1.4	3.4	1
1.2	Booster Upgrades	9.8	11.2	2
1.3	Main Injector Upgrades	15.0	17.0	3
1.4	Project Management	2.0	3.4	
1.5	Proton Study Group	0.0	0.1	

Variance Notes:

1. 1.1.4 - LLRF not started due to lack of RF resources. Now assigned.
2. 1.2.1 – Determine Rep Rate Limit delayed from lack of RF resources. Now moving forward.
3. 1.3.3.2 – Injection Kicker Mods. Design and Prototype had a later start than planned and efforts are being stretched because of delayed shutdown.

Changes

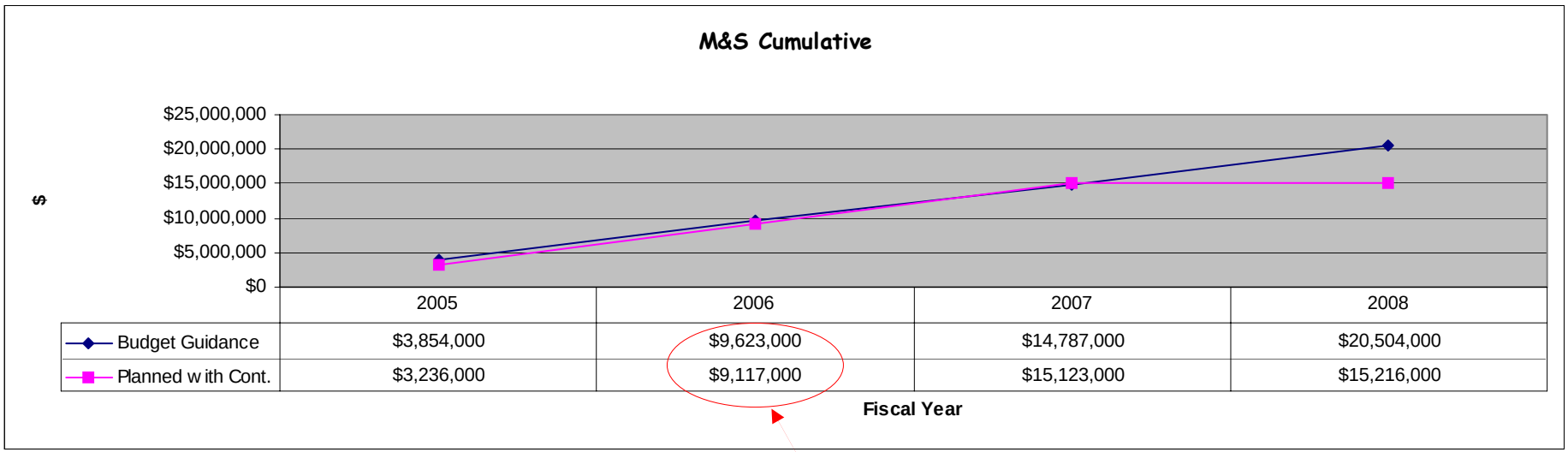
- CR-1: Labor Estimate Revision #1 (Ready for signature)
  - Scope:
    - latest estimate of AD labor required (EES, MSD).
    - Directorate Review comments on corrector installation labor.
    - Includes subproject shifts due to new shutdown (Chopper)
    - Moved Corrector Fab. tasks into FY06 for Procurement reasons
  - SWF Increase = $224k
  - M& S Increase = $48k
  - Schedule Impact = No Class A milestones impacted.
  - M&S Obligation Profile Change (Esc M&S no Cont.):

FY05	FY06	FY07	FY08	FY09	Total
-$252.9	$710.1	-$411.1	$1.7	$0.0	$47.8

- CR-2: WQB Magnet Fabrication (In Progress)
  - Scope:
    - Redesign required for the crossover bus.
    - Utilizing Subcontract Labor to supplement workforce…M&S
  - SWF Increase = $21k
  - M& S Increase = $47k
  - Schedule Impact = No Class A milestones Impacted.

M&S Spending Profile
Shown at last month's PMG

Proton Plan Baseline	FY05	FY06	FY07	FY08	FY09	Total
Escalated M&S	$2,807	$3,680	$3,449	$66	$0	$10,002
Escalated M&S Contingency	$429	$2,201	$2,557	$27	$0	$5,213
Total	$3,236	$5,881	$6,006	$93	$0	$15,216

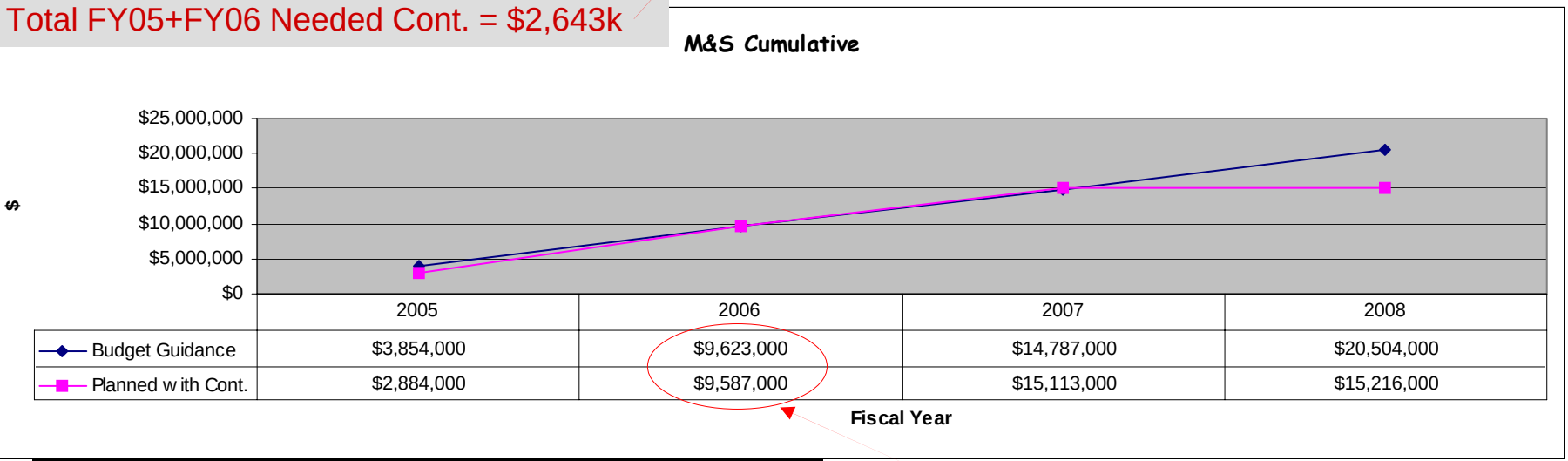


Apparent disparity between need and guidance of $500k

M&S Spending Profile With CR-1

Proton Plan Baseline	FY05	FY06	FY07	FY08	FY09	Total
Escalated M&S	$2,555	$4,389	$3,038	$68	$0	$10,050
Escalated M&S Contingency	$329	$2,314	$2,488	$35	$0	$5,166
Total	$2,884	$6,703	$5,526	$103	$0	$15,216

Total FY05+FY06 Needed Cont. = $2,643k



Disparity No More!

FY06 Guidance	5,769
FY05 Carry Forward	1,830
FY05 "Pay Back" - TD Work	(316)
FY06 Available M&S Funds	**7,283**
FY05 Planned Obligations	(4,504)
Proposed AD Held Working Contingency	(179)
Directorate-held Contingency	**2,600**

Other Issues

- Working toward fully developing 1.1.2 -LQPS Card Replacement and 1.1.4 -LLRF
  - Develop Engineers Estimates – Reduce Contingency
  - Process CR Eventually
- Will expand WBS 1.5 - Proton Study Group with Alberto Marchionni as Manager to include future efforts for development of the next stage of the Proton Plan.
- Will work with AD RF department to develop 1.2.9-Booster Solid State RF Upgrade… Currently 0$
- We are currently working with a consultant from Welcome™ to structure the automated EV and Obl reports for future PMG's.